Availability Assurance Project
Critical Systems Evaluation

Generating Station				Equivalent Hours of Lost Generation			Criticality Factor
				Unit 1	Unit 2	Station	
AP	Auxiliary Power Supply			**35.04**	**10.26**	**45.3**	
		APA	AC Power Supply (120 V)	2.96		**2.96**	2
		APC	AC Power Supply (480 V)	2.37	10.26	**12.63**	2
		APE	AC Power Supply (6900 V)	28.54		**28.54**	2
		APH	DC Power Supply				2
		API	Essential Service AC	1.17		**1.17**	2
		APJ	Essential Service DC				2
CA	Compressed Air				**6.35**	**6.35**	
		CAB	Control Air		6.35	**6.35**	2
CC	Combustion Gas Cleaning and Exhaust				**9.48**	**9.48**	
		CCE	Induced Draft				2
CO	Control			**12.66**	**53.62**	**66.28**	
		COA	Coordinated Control (DCS)	12.66	53.62	**66.28**	1
		COC	Unit Protection				1
		COF	Control and Multi-System Panels				2
EC	Equipment Cooling						
		ECB	Closed Cycle Cooling Water				2
FW	Feedwater			**206.92**	**109.05**	**315.97**	
		FWA	Boiler Feed	189.54	109.05	**298.59**	1
GT	Generator Terminal			**183.69**	**221.98**	**405.67**	
		GTA	Generator Bus Duct	157.59	46.56	**204.15**	1
		GTB	Generator Transformer	26 1	175 42	**201.52**	1
HR	Cycle Heat Rejection			**75.05**	**92.5**	**167.55**	
		HRA	Condensing	51.65	92.5	**144.15**	2
		HRC	Circulating Water	23.18		**23.18**	2
		HRD	Circulating Water Make-Up	0 22		**0.22**	2
		HRE	Circulating Water Chemical Feed				3
PP	Primary Power Supply						
		PPA	Substation				1
		PPB	Contingency Arming Testing				2
SG	Steam Generation			**3217.58**	**2692.34**	**5909.92**	
		SGA	Steam Generator	1517.06	1145.47	**2662.53**	1
		SGB	Combustion Air Supply	49 59	65.27	**114.86**	2
		SGF	Boiler Vents and Drains		63.55	**63.55**	1
		SGG	Main Steam	111.72	190.03	**301.75**	1
		SGH	Burner and Mill Controls	44.7	23.15	**67.85**	1
		SGI	Soot Blowing		45.38	**45.38**	2
		SGJ	Reheat Steam		14.02	**14.02**	1
TE	Turbine Extraction			**10.91**		**10.91**	
		TEA	High Pressure Extraction				2
		TEB	Low Pressure Extraction	8.28		**8.28**	2
		TEC	Extraction Traps and Drains				2
		TED	High Pressure Drains	0.05		**0.05**	2
		TEE	Low Pressure Heater Drains	2.58		**2.58**	2
TG	Turbine Generator			**725.55**	**1375.66**	**2101.21**	
		TGA	Turbine	395 83	25.69	**421.52**	1
		TGB	Generator and Excitation	241.89	1196.46	**1438.35**	1
		TGC	Turbine Seals and Drains	5.16		**5.16**	2
		TGE	Generator Cooling and Purge	5.52		**5.52**	2
		TGF	Turbine Control and Instrumentation	77.15	153 51	**230.66**	1
Converter Station							
Converter Station							
B1DC	Bipole Common - Electrode						
		B1DC-O	Bipole Equipment to Electrode	7 6		7.6	2
		B1DC-E	Bipole Electrode and Line	1.36	1.36	2.72	1
P1DC	Converter Station Pole 1						
		P1DC-H	High Voltage Bus	31.19	4.16	35.35	2

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		P1DC-N	Neutral Bus				2
		P1DF	Pole 1 DC Filters				2
		P1VH	Pole 1 Valve Hall				2
		P1AC	Pole 1 AC Yard	4.26	4.36	8.62	2
P2DC	**Converter Station Pole 2**						
		P2DC-H	High Voltage Bus	8.81	1.89	10.7	2
		P2DC-N	Neutral Bus				2
		P2DF	Pole 2 DC Filters				2
		P2VH	Pole 2 Valve Hall				2
		P2AC	Pole 2 AC Yard	5.58	2.1	7.68	2
STA	**Station AC Filters**						
		STA 1	AC Filter Bank 1	16.26	4.59	20.85	2
		STA 2	AC Filter Bank 2				2
		STA 3	AC Filter Bank 3				2
SWE	**Station AC Switchyard Equipment**						
		SWE-2	Bank M Equipment - Gonder				2

Criticality 1 = Equipment failure causes 100% load loss immediately. No Redundancy
Criticality 2 = Equipment failure causes partial load loss immediately. Redundancy not capable of 100% output
Criticality 3 = Equipment failure causes no load loss. Redundancy capable of 100% output
Criticality 4 = Equipment failure causes only inconvenience. All other process equipment not directly tied to production.

IGS- GREENHOUSE GAS REDUCTION PROJECTS 12/10/07

1) HEAT RATE IMPROVEMENT PROJECTS

1a. **LP Turbines (3) Upgrade**- replace rotor and inner casing
Turb Efficiency and Turbine Cycle Performance Improvements

1b. **IP Turbine Upgrade**- replace rotor and inner casing
Turb Efficiency and Turbine Cycle Performance Improvements

1c. **Cooling Tower (CCT- concrete) Performance Improvements**
(mechanical upgrade- water distribution system and nozzles, drift eliminators, PVC fill, etc)

1d. **Primary Air Heater- performance upgrade and air leakage reduction system**
(replace baskets and increase number of sections)
reduce prim air leakage to allow low speed- PA fan operation

1e. **Instrumentation Improvements**
Feedwater Flow Nozzle- accuracy issues

1f. **Pulverizer Uprate- rotating throats and static classifier**
Improve capacity of pulverizer (reduce aux power and improved fineness)

2) ADVANCED CONTROLS

(utilize "next generation" advanced controls technology)

2a. **DCS- neural network automation of combustion system**
(optimize NOx, CO and CO2 emissions and unburned carbon in bottom and fly ash (perf issue) by controlling bad actor burners which are producing high CO)

Burners (sec air)- automate outer air hoods with actuators
Burners (coal)- automate coal line restrictors with actuators
Instrumentation Improvements- add CO (unburned combustibles) grid at economizer backpass, get burner IBAMS (sec air flow measurement) working correctly, also add permanent coal flow measurement per burner line (ultrasonic)
Turning Vanes- add turning vanes in secondary air ductwork
Note- another key factor is automate neural net of overfire air system

2b. DCS NeuralNet- Sliding Pressure Operation
(optimize control valve throttling losses by lowering main steam pressure vs problems with high heat in boiler at the lower boiler pressure)

2c. DCS NeuralNet- Desuperheating Spray Flows
(high use of primary and secondary spray flows vs boiler air flow and excess air)

3) **AUXILIARY POWER REDUCTION**

3a. **Primary Air Fan- add variable speed drives**
(better PA duct press control and not big power hit as two speed motor)

3b. **Pulverizer Motors- upgrade motors**
Upgrade motors with TECO (5 amp ave reduction)

3c. **Cooling Tower Fans- variable speed drive**
(power savings in winter months from reduced fan horsepower)

3d. **Circulating Water Pumps- variable speed drive and/or upgraded motors**
(power savings in winter months from reduced pump horsepower)

3e **Forced Draft Fan- upgraded motors**
(improved efficiency motor)

3f. **Induced Draft Fan- upgraded motors**
(improved efficiency motor)

4) **OTHER PROJECTS**

4a. **Heat Input Calculation Method**
Resolve problems with EPA calc methods versus coal quality and coal quantity measurements

4b. **Natural Gas Burners**
Natural gas versus fuel oil fired burners